

Foundations of Artificial Intelligence

Prof. Dr. B. Nebel, Prof. Dr. W. Burgard
 B. Frank, A. Karwath, G. Röger
 Summer Term 2009

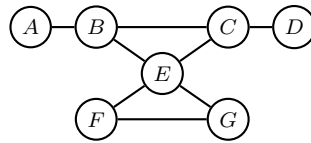
University of Freiburg
 Department of Computer Science

Exercise Sheet 4

Due: Tuesday, May 26, 2009

Exercise 4.1 (Tree decompositions for CSPs)

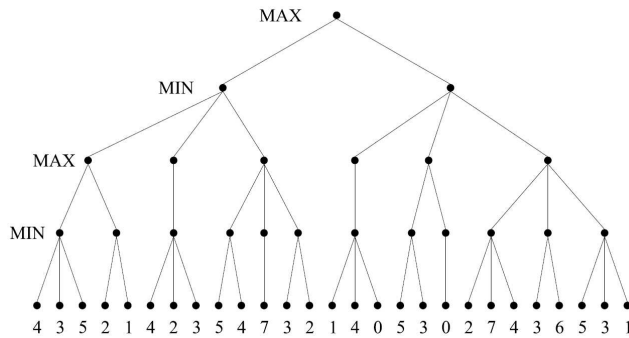
You want to 3-color the following graph (say with the colors r, g, b).



Show a minimal tree decomposition of the graph and give the sets of all solutions for each of the subproblems. Merge the solutions of the subproblems into an overall solution in the way presented in the lecture. Write down such an overall solution.

Exercise 4.2 (Minimax algorithm)

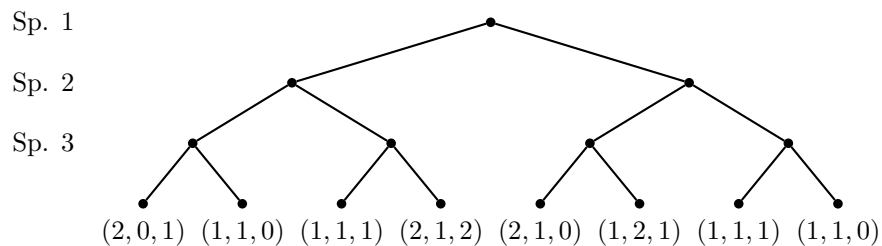
- Perform the minimax algorithm in the tree in Figure 1 using $\alpha\beta$ -pruning. Traverse the tree from left to right. Annotate the nodes with their alpha and beta values.
- Can the nodes be ordered in such a way that $\alpha\beta$ -pruning can cut off more branches? If so, give the order. Otherwise, argue why not.



Exercise 4.3 (Generalization of the Minimax algorithm)

Consider the problem of search in a three-player game (you may assume that no alliances are allowed) without the zero-sum condition. The players are called 1, 2, and 3. Unlike in the case of two-player zero-sum games, the evaluation function now returns a triple (x_1, x_2, x_3) such that x_i is the value the node has for player i .

- (a) Complete the game tree given below by annotating all interior nodes and the root node with the backed-up value triples.
- (b) Assume that the value triple $(1, 1, 1)$ at the third leaf nodes from the left is replaced by $(0, 1, 2)$. Which problem arises now when you try to back up value triples? Suggest how to modify the back-up procedure to obtain a “robust” result at the root node.



Exercise 4.4 (Propositional Logic)

Formalize the following as a set KB of propositional formulae:

If the unicorn is a mythological creature then it is immortal. But, if it is not a mythological creature then it is a mammal. If the unicorn is immortal or a mammal then it is horned. A unicorn is a magical creature if and only if it is horned.

Does it follow from KB that the unicorn is

- (a) a mythological creature,
- (b) a magical creature,
- (c) a horned creature?

The exercise sheets may and should be handed in and be worked on in groups of three (3) students. Please fill the cover sheet¹ and attach it to your solution.

¹<http://www.informatik.uni-freiburg.de/~ki/teaching/ss09/gki/coverSheet-english.pdf>